

Vegetation Response to a Demonstration Drawdown on Pool 8 of the Upper Mississippi River

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Introduction

The annual cycle of fluctuation in water levels has been modified on the Upper Mississippi River, primarily by the system of dams installed by the U.S. Army Corps of Engineers in the 1930s to enhance commercial navigation. The navigation pools that resulted from the artificially-maintained high water levels were initially diverse in structure and supported a rich variety of fish and wildlife. Over time, the high water levels have contributed to a degradation in the habitat quality of these pools and large expanses of open water have developed that provide little benefit to fish and wildlife resources. In an effort to enhance the production of aquatic vegetation and improve fish and wildlife habitat, the U.S. Army Corp of Engineers conducted a pilot drawdown on Navigation Pool 8 during the summers of 2001 and 2002. The drawdown involved reducing Pool water levels by 1.5° at Lock and Dam 8 during the growing season.

Timing and Duration of the Drawdown

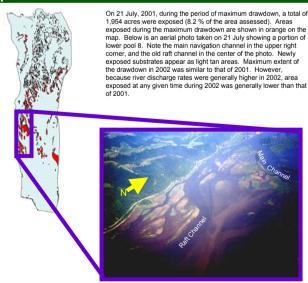
The 2001 drawdown was scheduled for mid-June, but delayed due to spring flooding and protracted high river flows. Consequently, the pool elevation at Lock and Dam (L&D) 8 did not reach normal pool elevation (630.0") until 30 June and drawdown was not effectively achieved until 6 July. The drawdown was maintained near the target level of 628.5" at L&D 8 for 40 days, until 14 August, or about 47% of the prescribed 85-day period. As river flow rates dropped to near 20,000 cubic feet per second, the minimum pool elevation at the La Crosse gauge could no longer be



under the 1.5' drawdown scenario. This necessitated restricting flow at L&D 8 to increase pool levels. The drawdown effectively persisted throughout the mid-portion of the pool (as depicted with Brownsville and La Crosse pool elevations on the figure to the right) through 15 September.

In 2002, the drawdown was maintained at target levels for 75 days, from 2 July through 15 September. River flow were variable throughout the summer but remained within prescribed drawdown flow constraints.

Exposed Substrates



Vegetation Response to the Drawdown

We assessed vegetation response to the water level reduction during the drawdown through (1) use of high-resolution aerial photography and land cover data generated from that photography. (2) field measures of the distribution and biomass of submersed aquatic vegetation (SAV), and (3) field measures of the composition and productivity of moist soil and emergent perennial vegetation on exposed substrates. The drawdown and/or spring flooding in 2001 likely contributed to an increase in deep marsh annual, shallow marsh perennial, wet meadow, sand bar, submersed aquatic vegetation, wet meadow shrub, shallow marsh annual, and mud communities in Pool 8.

Class_31_Name	Acres_2000	% Total	Acres_2001	% Total	Ac. Diff	% Diff	% Change
Deep Marsh Annual	53.0	0.1%	427.2	1.1%	321.2	1.0%	705.5%
Deep Marsh Perennial	1184.0	3.2%	1236.8	3.3%	52.8	0.1%	4.5%
Deep Marsh Shrub	3.7	0.0%	1.3	0.0%	-2.4	0.0%	-65.3%
Grassland	23.2	0.1%	20.3	0.1%	-2.9	0.0%	-12.4%
Lowland Forest	90.1	0.2%	64.6	0.2%	-25.5	-0.1%	-28.3%
Mud	84.3	0.2%	159.6	0.4%	75.3	0.2%	89.49
Open Water	14672.7	39.4%	13456.4	36.1%	-1216.3	-3.3%	-8.3%
Plantation	2.9	0.0%	3.4	0.0%	0.5	0.0%	16.3%
Populus Community	72.5	0.2%	203.2	0.5%	130.7	0.4%	180.2%
Rooted Floating Aquatics	2426.9	6.5%	2414.1	6.5%	-12.8	0.0%	-0.5%
Salix Community	791.4	2.1%	792.4	2.1%	1.0	0.0%	0.1%
Sand	28.1	0.1%	48.2	0.1%	20.1	0.1%	71.4%
Sand Bar	14.6	0.0%	170.4	0.5%	155.8	0.4%	1064.75
Sedge Meadow	3.5	0.0%	0.3	0.0%	-3.2	0.0%	n/a
Shallow Marsh Annual	0.0	0.0%	99.9	0.3%	99.9	0.3%	n/a
Shallow Marsh Perennial	1608.5	4.3%	1938.0	5.2%	329.5	0.9%	20.5%
Shallow Marsh Shrub	33.5	0.1%	0.0	0.0%	-33.5	-0.1%	n/a
Shrub/Scrub	14.0	0.0%	0.0	0.0%	-14.0	0.0%	n/a
Submerged Aquatic Vegetation	3922.9	10.5%	3991.3	10.7%	68.4	0.2%	1.75
Wet Meadow	2649.8	7.1%	2897.7	7.8%	247.9	0.7%	9.49
Wet Meadow Shrub	127.9	0.3%	231.2	0.6%	103.3	0.3%	80.79

Vegetation Response on Exposed Sites

We monitored the development of vegetation on exposed substrates along 26 transects throughout Pool 8 (south of Root River). We found more than 50 species of moist soil, perennial emergent, and aquatic species. Rice cut-grass, broadleaf arrowhead, water stargrass, nodding smartweed, chufa flatsedge, false pimpernel, and teal love grass were the dominant species that developed on exposed substrates. Growth progressed well in 2001 despite the later-than-scheduled drawdown and hot, dry conditions during much of July. Plant density was related to the duration of substrate exposure, with higher plant densities and more plant development occurring on substrates exposed for a good portion of the growing season (i.e., mit-pool sites that remained exposed through mid-September) and low plant density on those substrates that were re-inundated in mid-August. We observed a shift from a plant community dominated by annuals to one dominated by perennials in 2002.



Seed & Tuber Yield of Emergent & Moist Soil Plants

A variety of moist soil and emergent plant species, important food resources to wildlife, grew on substrates exposed during the drawdown. The plants that developed at a particular site depended on a number of variables, including soil moisture and timing and duration of substrate exposure. Seed production in 2001 was dominated by rice cut-grass (51% of total production), chufa flatsedge (13%), barnyard grass (13%), and nodding smartweed (11%). Seed yield tended to be higher on those transects located in the mid-Pool area (e.g., transects 15, 12, and 10). Tuber production in 2001 was dominated by arrowhead (52%) and sago pondweed (44%). In 2002, arrowhead made up 94% of total tuber production. Arrowhead tuber production increased 16-fold (

3.4 g/m² in 2001 vs. 55.3 g/m² in 2002) across transects we examined during the two years.

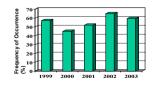
Seed and Tuber Production on Exposed Substrates of Pool 8, 2001 & 2002

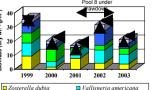
Seed and Tuber Production on Exposed Substrates of Pool 8, 2001 & 2002							
	Seed Yield	Tuber Yield (g/m² dry wt)					
Sample Site	2001 (g/m² dry wt)	2001 Tuber Yield	2002 Tuber Yield				
15 (Lawrence Lake)	16.2 ± 4.8	NA	NA				
12 (Shady Maple)	45.6 ± 6.5	11.2 ± 5.4	224.9 ± 62.8				
16 (Brownsville)	17.2 ± 7.5	2.0 ± 1.5	73.2 ± 57.5				
11 (Stoddard Islands)	2.5 ± 3.9	20.8 ± 16.7	119.2 ± 50.2				
7 (Raft Channel)	7.5 ± 4.2	5.3 ± 2.4	114.0 ± 40.1				
1 (Coon Creek Delta)	0.4 ± 0.3	13.6 ± 3.3	21.0 ± 6.6				
2 (Spring Creek)	0.6 ± 0.3	5.2 ± 5.2	22.4 ± 14.5				
10 (Genoa – L&D 8)	0	0	0.1 ± 0.1				

Response of Submersed Aquatic Vegetation

In general, submersed aquatic vegetation did not appear to be negatively effected by the drawdown. Submersed aquatic vegetation standing crop biomass was significantly lower in 2000 and 2001 (— <20 g/m2) from 1999 levels (35 g/m2) and rebounded to 32 g/m2 in 2002. In the near future, we will determine the persistence of emergent perennial plant beds that were reestablished as a result of the drawdown and continue to assess the distribution and abundance of submersed aquatic vegetation.

Frequency of occurrence and mean standing crop biomass of submersed aquatic vegetation in UMR Navigation Pool 8





■ Ceratophyllum demersum ■ Elodea canadensis
■ Other

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